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REITZ AND JENS INC ST LOUIS MO

NATIONAL DAM SAFETY PROGRAM. COLE LAKE DAM, NO NAME 249 (NO 304--ETC(U)

NOV 78 H M REITZ, J J BAILEY

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NO NAME 249

JEFFERSON COUNTY, MISSOURI

MO 30430

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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NOVEMBER 1978

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105 295	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Cole Lake Dam - NO NAME 249 (MO 30430) Jefferson County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report.
7. AUTHOR(s) Reitz & Jens, Inc.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		8. CONTRACT OR GRANT NUMBER(s) DACW43-78-C-0162
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 1-30-310-4-1		12. REPORT DATE November 1978
		13. NUMBER OF PAGES Approximately 45
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
16. DISTRIBUTION STATEMENT (of this Report) Approved for release; distribution unlimited.		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) National Dam Safety Program. ✓ No Name 249 (MO 30430), Mississippi - Kaskaskia - St. Louis Basin, Jefferson County, Missouri. Phase I Inspection Report.		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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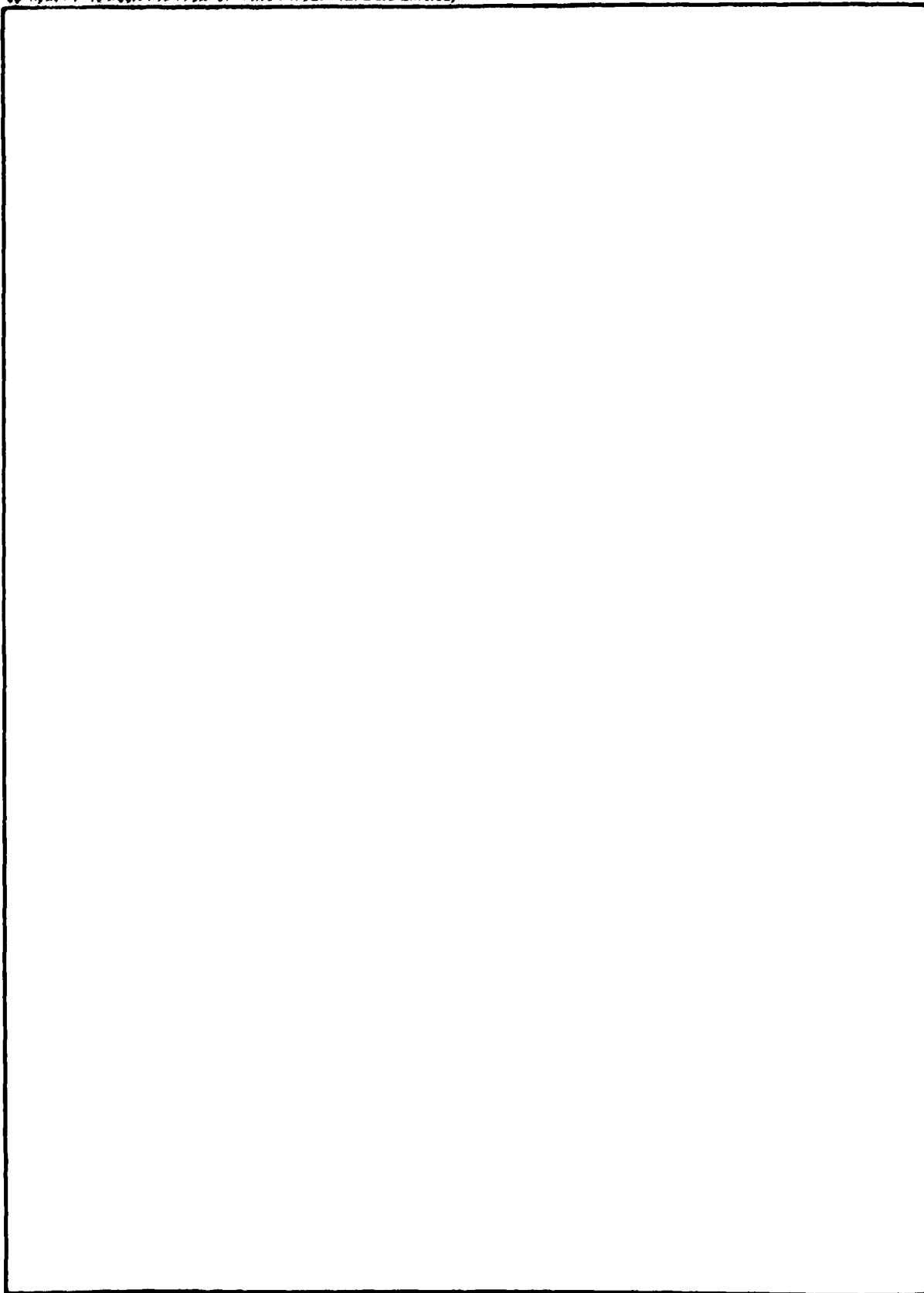
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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: No-Name 249 Dam, MO ID No. 30430
Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the No-Name 249 Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

- 1) Spillway will not pass 30 percent of the Probable Maximum Flood.
- 2) Overtopping could result in dam failure.
- 3) Dam failure significantly increases the hazard to loss of life downstream.
- 4) Dam slopes have locally heavy tree and underbrush growth.

SUBMITTED BY: SIGNED 18 FEB
Chief, Engineering Division Date

APPROVED BY: SIGNED 12 FEB 1979
Colonel, CE, District Engineer Date

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	No-Name 249 Dam
State Located	Missouri
County Located	Jefferson County
Stream	Heads Creek
Date of Inspection	29 November and 18, 19 and 20 October 1978

No-Name 249 Dam was inspected by an interdisciplinary team of engineers, from Reitz & Jens, Inc. under contract with the St. Louis District Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations and private engineers. Based on these guidelines, this dam is classified as a small dam with a high downstream hazard potential. The estimated damage zone from failure of the dam extends three miles downstream from the dam.


Failure would threaten the life ~~the life~~ and property of four families and cause appreciable damage to associated buildings and one county road to the junction with an east-trending branch (3 miles) and 10 more families within one mile below the junction.

Our inspection and evaluation indicates that the dam is deficient in that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Considering the potential volume of water impounded, the narrow floodplain and the four groups of buildings downstream, and the potential for future development in or near the floodplain downstream, the Probable Maximum Flood (PMF) is the appropriate spillway design flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions reasonably possible in the region. The dam will begin to be overtopped by a flood having a discharge (peak and volume) equal to 30% of the PMF. The spillway will pass a 1% chance flood (100-year flood) without overtopping which is a flood that has a 1% chance of being exceeded in any given year.

Another deficiency found was lack of seepage and stability analysis records.

Other deficiencies observed by the inspection team were inadequate protection of the spillway and toe of the dam from erosion by spillway discharges, unrepaired slides on the upstream face of the dam and a heavy growth of trees and brush on both faces of the dam.

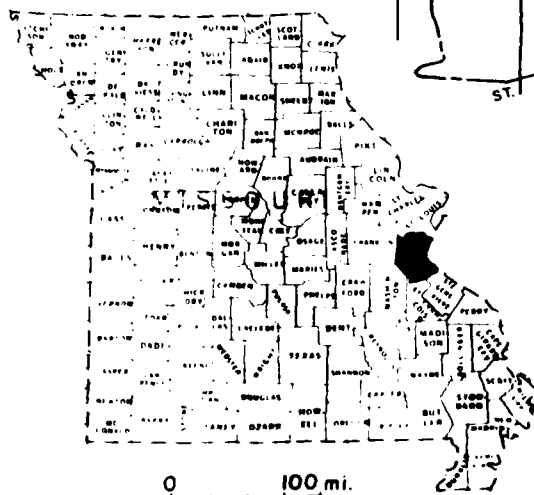
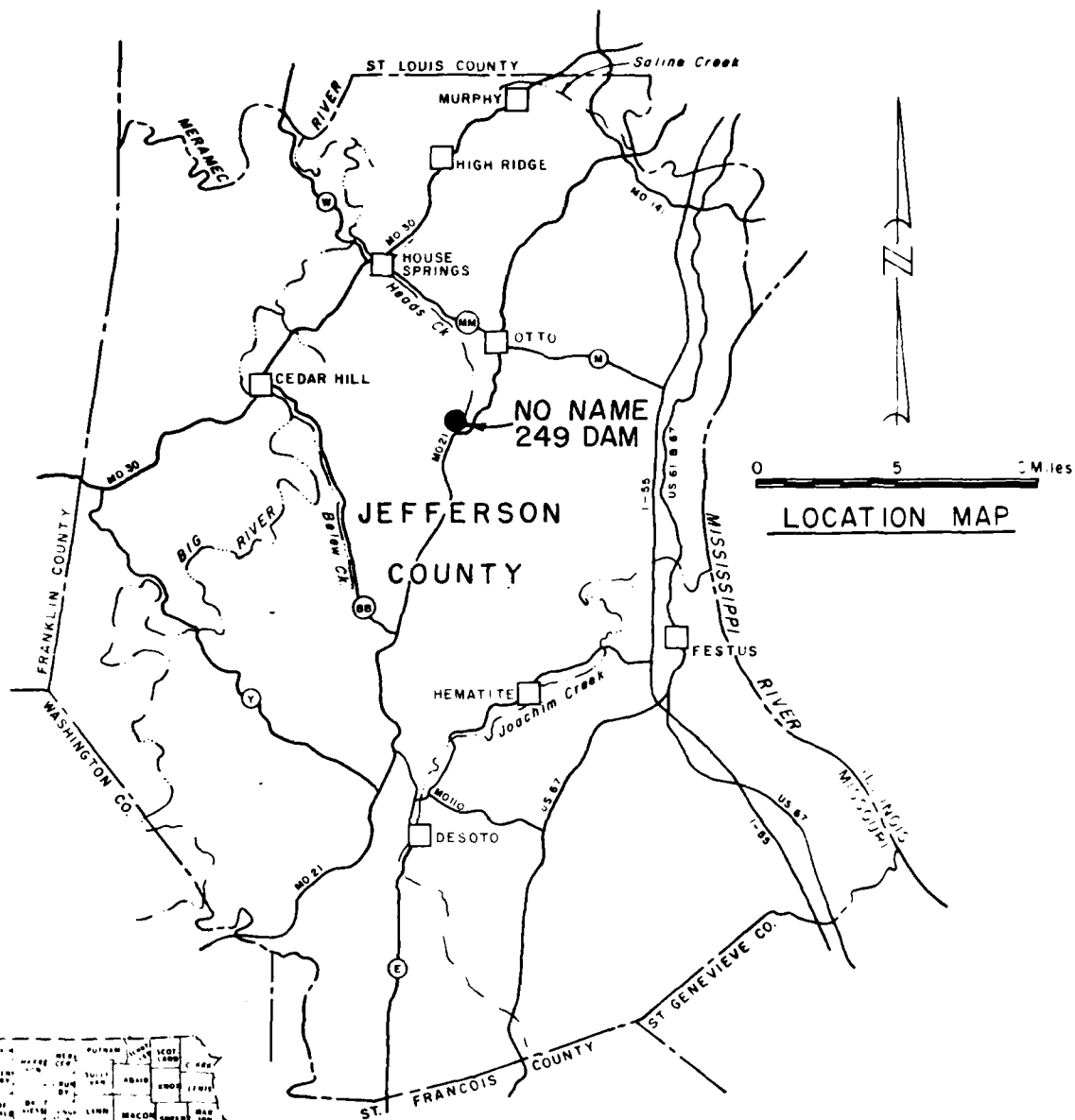
We recommend the owner take prompt action to correct or control the deficiencies described.


HENRY M. REITZ, President
Reitz & Jens, Inc.


JOHN J. BAILEY, JR., Vice President
Chief Engineer, Reitz & Jens, Inc.



OVERVIEW-30430



PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NO-NAME 249 DAM, MO ID NO. 30430

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1	Overview - Lake and Environs
2	Location and Vicinity Map
3	Plan and Profile Sheet (in pocket on back cover)
A-1 (5 sheets)	Hydrologic and Hydraulic Computations (HEC-1 Input and Output)

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1	Index of Dam Photos (D-1 through D-11)
2	Index of Panorama Photos (P-1 through P-5)
3	Index of Spillway Photos (S-1 through S-4)
4	Index of Valley Below Dam Photos (V-1 through V-3)
5	Index of Seepage Photos (SE-1 through SE-2)

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer contracted with Reitz & Jens, Inc. (Contract DACW43-78-C-0162) for a safety inspection of the No-Name 249 Dam, MO ID No. 30430.

b. Purpose of Inspection The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

(1) The dam is an earth structure built across a narrow valley at the headwaters of Heads Creek in the Sand Ridge Hills of Jefferson County. The general classification of soils is Union Silt Loam. About 60% of the drainage area in the northern portion of the watershed consists of steep "V" shaped valleys between sharply defined (razor back) ridges and is covered with woods. The remainder is steeply rolling. An appreciable portion of this southern 40% was once cultivated. At the present time, this portion is subdivided. About a dozen homes have been built in this area, and it is probable that 20 or 30 more may be constructed in the future. The spillway is low part of the dam crest where it joins the east valley slope. Discharge is into a valley running northwestwardly parallel to the dam axis.

Topography in the vicinity of the dam is shown on Plate 3

Pertinent physical data are given in paragraph 1.3 below.

b. Location The dam is located in east central Jefferson County about three miles southwest of Otto as shown on Plate 2. The dam and lake are located in the SW $\frac{1}{4}$ of the NE $\frac{1}{4}$ of Section 36 T42N, R4E and are shown on the Jefferson County, Belew Creek Quadrangle Sheet, 1968 Edition. The dam and lake were not shown on the 1954 edition of this quadrangle sheet.

c. Size Classification Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the small size category.

d. Hazard Classification Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification.

e. Ownership The dam is owned by Mr. Claude Cole, Route #2, Imperial, Missouri 63052.

f. Purpose of Dam The dam forms a 7-acre recreational lake at normal pool elevation about 20 feet below spillway crest.

g. Design and Construction History The inspection team was unable to find any design data on this dam. It appears from the USGS Map that it was constructed between 1954 and 1968. See paragraph b. above.

h. Normal Operating Procedure Normal rainfall and runoff are inadequate to maintain a full reservoir. See paragraphs 3.1.b and 2.3.

1.3 PERTINENT DATA

a. Drainage Area - 190 acres

b. Discharge at Damsite

(1) All discharge at the damsite is through an uncontrolled spillway. At the present time however all runoff appears to leak through the sides and/or bottom of the reservoir.

(2) Estimated experienced maximum flood at damsite - unknown

(3) Estimated ungated spillway capacity at maximum pool elevation - 460 cfs.

c. Elevation (Feet Above M.S.L.)

(1) Top of dam - 802.3 to 803.4 (See Plate 3)

(2) Spillway crest - 799.7

(3) Streambed at centerline of dam - 763.8 (est.)

(4) Maximum tailwater - unknown

d. Reservoir Length of maximum pool - 1900 feet \pm (Estimated from USGS Map).

e. Storage

(1) Top of dam - 293 acre feet.

(2) Spillway crest - 248 acre feet

f. Reservoir Surface

- (1) Top of dam - 18.5 acres
- (2) Spillway crest - 16.3 acres (estimated from USGS Map).

g. Dam

- (1) Type - earth embankment.
- (2) Length - 500 feet
- (3) Height - 39.6 feet maximum (from survey)
- (4) Top width - 7± feet
- (5) Side Slopes -
 - (a) Downstream - 1V on 2.5H (average) (determined from section at Station 4+50 see Plate 3) Upper part about 1V on 2H lower portion 1V on 3H.
 - (b) Upstream - Irregular - averages 1V on 2H to water surface.
- (6) Zoning - unknown
- (7) Impervious core - unknown
- (8) Cutoff - unknown
- (9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - None

i. Spillway Saddle type discharging over natural slope into lateral valley downstream of toe of dam. Spillway is "V" shaped about 3-feet deep and has top width of about 90 feet.

j. Regulating Outlets - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were found to be readily available.

2.2 CONSTRUCTION

No data on construction of the dam were found to be available.

2.3 OPERATION

The maximum loading on the dam is unknown. The lake level seems to remain 15 to 25 feet below crest spillway during average precipitation of 38 inches per year. There are no records of operation of the dam.

It appears from the condition of the spillway that it has never carried discharge from the reservoir.

2.4 EVALUATION

a. Availability No engineering data were found to be available.

b. Adequacy No engineering data were available. The owner should have an engineer, experienced in the design of dams, perform detailed seepage and stability analyses.

However, for the size of dam, materials used and measurements taken, a satisfactory hydrologic/hydraulic evaluation resulted.

c. Validity This report is primarily for safety through maintenance and operation and the conclusions and evaluation for this Phase I Inspection are considered to be adequate for the definitive statement in this report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General A visual inspection of No-Name 249 dam was made on 29 November 1978. This followed three days of field measurements by a survey party on 18, 19 and 20 October 1978. The training and experience of personnel in these inspections included hydrologic/hydraulic engineering, soils and materials engineering, surveying and structural engineering.

b. Dam This is an earth dam. The borrow for it appears to have been taken primarily from its reservoir area. Soils visible on the surfaces of the dam have some gravel size and smaller rock content but are predominantly fine-grained. Top width is approximately 7 feet at the center of the dam (D-2, D-7, D-9). The height of embankment is 39 feet. The downstream slope (D-3, D-10) averages 1V on 2.5H but is steeper at the top and flatter at the bottom. The upstream slope is quite irregular and in its west half, visually appears to have had slides (D-6, D-7). The top of dam varies approximately two feet in its length of 500. A row of willow trees is growing on the reservoir slope of the dam (D-1, D-2, D-8) about 20 feet below top of dam at about existing water level. This seems to indicate that rarely has the lake been filled and its permanent level seems to be 12 to 25 feet below the top of the dam.

Visible on the west shore, above the waterline, is a ledge limestone outcrop (D-11, P-2). The bedrocks in this area appear to be of the Ordovician System. Both slopes of the dam as well as the top of the dam (D-4 through D-9) have a mixture of trees and thickets of underbrush indicative of absence of maintenance. The reservoir depth beneath the water surface is less than half the potential depth of water that could be stored by the dam and accordingly, the volume stored in the reservoir at the time of inspection was no greater than 25% of the potential storage. With the low head of water in the lake behind the dam, no indications of through-seepage or underseepage were observed. However, because of the very low lake level, the absence of indications of through-seepage or underseepage does not give assurance that the potential for either does not exist at this dam. No digging wastes or similar signs of animal activity were visible. The thick underbrush made visual examination of the total dam surface virtually impossible.

c. Appurtenant Structures There is a spillway at the east end; however, due to the apparent inability to fill the reservoir, there were no visual indications that water had ever flowed through the spillway (S-3, S-4).

Drainage from an area of about 35 acres south and east of the dam flows northwesterly across the valley at the toe of the dam. Erosion had cut a ditch but this does not appear to have resulted from use of the spillway (S-1, S-2, S-3).

d. Reservoir As indicated, there is exposed rock along the reservoir area (P-2, P-4) and the weathered slope of the dam is barren earth except for the tree and underbrush growth. Again, in the central portion of the reservoir especially on the east side, there are extensive flats (P-1, P-3, P-5), suggesting either sediment deposit by water running into the lake or bottom of a borrow pit that may have been used to build the dam.

3.2 EVALUATION

Site observations show a significant problem of loss of water. The site conditions which prevent filling the lake and keeping it nearly full except

for abstractions due to evaporation, prevent assessment of potential seepage and bank erosion. Erosion of the bottom of the spillway with aggravated discharge resulting is recognized as a possibility should the reservoir ever be filled either by stoppage of the leakage or by extremely heavy rainfall (i.e. a PMF).

Two other conditions observed were slides on the upstream face of the dam and uncontrolled heavy growth of trees and shrubs on both faces of the dam. Both of these conditions, if unattended to, could develop a serious potential of failure should the reservoir fill. Unrepaired slides weaken the dam, trees and shrubs provide shelter and habitat for burrowing animals whose activity could lead to seepage through the embankment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation and seepage into the bottom and/or sides of the reservoir.

4.2 MAINTENANCE OF DAM

Based on the amount of brush and size of trees on the slopes of the dam, little or no mowing to control such growth has been done since construction of the dam.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

If the uncontrolled vegetation on the downstream slope is allowed to continue, a serious potential of failure may develop.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data No design data were found to be available.

b. Experience Data The drainage area is developed from USGS Belew Creek Missouri Quadrangle. Also available are 1"=2000' aerial stereo pairs taken 9 April 1977, by Surdex Corp. Lake area is measured on a 1"=200' enlargement of a portion of one of these photographs and shown on Plate 1. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations

(1) The spillway and exit channel are located at the east end of the dam. Spillway is saddle type discharging into a lateral valley. Flows from this valley cross the floodplain below the downstream slope of the dam in a ditch close to the toe of dam. Maximum spillway releases, should the lake ever fill and such occur, could erode the lower portion of the dam embankment and possibly cause sloughing or sliding of the dam.

(2) No drawdown facilities are available to evacuate the pool.

d. Overtopping Potential

(1) Although the lake seems to remain well below spillway elevation, prudent engineering analysis requires that spillway capacities be evaluated on the basis of a reservoir full to the spillway crest. On this basis the spillways are too small to pass the minimum required flood of the probable maximum without overtopping. The probable maximum flood is defined as the flood discharge expected from the most severe combination of critical meteorologic and hydrologic conditions reasonably possible in the region. The dam will start to be overtopped by a flood equal to 30% of the PMF. The PMF will overtop the dam to a maximum depth of about 1.8 feet. The depth will vary to zero across the dam because of the sloping crest. A width of 400 feet of dam crest will be subject to some overtopping flow. Maximum rate of flow over the dam crest will be about 2100 cubic feet per second. Overtopping flow will have a duration of about 5 hours. The existing lake and spillway will contain a 100-year frequency flood below the crest of the dam.

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, the 100-year frequency flood is only adequate for a low hazard dam of small size.

(2) At the current pool elevation, 19.3 feet below the spillway crest, the lake has capacity to retain a one-day 100-year flood without reaching the spillway crest. Assuming a start at the current pool elevation, overtopping of the dam would begin to occur for a flood equal to 60% of the one-day PMF. Because a drawdown tube is absent, there is no assurance the pool will remain at the current elevation. In the future, it is possible that the reservoir will be full at the beginning of a period of intense rainfall. Therefore, the statements in this paragraph cannot justify the lack of adequate spillways but can be used to evaluate the urgency for necessary correction.

(3) The effect from rupture of the dam could extend approximately three miles downstream of the dam. There are ten to twelve inhabited homes downstream of the dam which could be severely damaged and lives of the inhabitants could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations Visual observations which adversely affect the structural stability of this dam are discussed in Section 3, paragraph 3.1.b.

b. Design and Construction Data No design or construction data relating to the structural stability of the dam were found.

c. Operating Records. No appurtenant structures requiring operation exist at this dam.

d. Post Construction Changes No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability Considering the seismic zone (2) in which this dam is located, an earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety Considering the potential volume of water impounded, the narrow floodplain, the twelve groups of buildings downstream and the potential for future development of the floodplain downstream, Probable Maximum Flood (PMF) is the appropriate spillway design flood. The spillway cannot carry the 30% PMF without overtopping the dam. The reservoir and principal spillway are adequate to contain a flood which has a 1% chance of being exceeded (100-year flood) in any given year.

Several items were noted during the visual inspection by the inspection team which should be corrected or controlled. The heavy growth of trees on the upstream and downstream slopes of the dam is a safety deficiency. An armor-coat to protect the reservoir slope of the dam against wave-wash is needed. Erosion protection for the spillway is deficient. Slides on the upstream face of the dam have not been attended to. Large spillway discharges could erode the toe of the dam.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency.

b. Adequacy of Information Due to lack of engineering design and construction data, the conclusions in this report were based on performance history and external visual conditions. The inspection team considers these data sufficient to support the conclusions herein.

c. Urgency The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the safety deficiencies listed in paragraph a are not corrected in the near future, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II Based on the results of the Phase I Inspection, no Phase II Inspection is recommended.

e. Seismic Stability This dam is located in Seismic Zone 2. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. The owner should obtain the services of an engineer experienced in the design and construction of dams to design and observe construction of the following remedial measures which would include preparation of seepage and stability analyses in conjunction with (2) below.

(1) Spillway size and/or height of dam should be increased to pass the PMF. Part of this work would include erosion protection for the spillway and measures to protect the toe of the dam from erosion by maximum spillway discharge.

(2) Repair the upstream slope of the dam where slides have occurred.

(3) Provide an armor-coat to protect the upstream face of the dam from wave-wash.

(4) Remove the heavy growth of trees and shrubs on the dam, grub stumps and roots, recompact and dress the slopes and seed, fertilize and mulch to establish a growth of turf on the slopes.

b. O&M Maintenance and Procedures The following O&M maintenance and procedures are recommended:

(1) After removal of existing tree growth, vegetation on the dam should be periodically cut.

(2) After completion of the remedial measures, detailed inspections of the dam should be made periodically by an engineer experienced in the design and construction of dams. Records should be kept of these inspections and major maintenance and repairs.

APPENDIX A
HYDROLOGIC CALCULATIONS

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation for those dams in the high hazard potential category is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33". Reduction factors have not been applied. A 24-hour storm duration is assumed with the 24-hour rainfall depths distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use and antecedent moisture conditions.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillway and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-area curve. The hydraulic capacity of the spillway and the sloping top of dam is defined by a composite elevation discharge curve.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on Plate 1A. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. The discharge in the spillway was calculated using critical depth at the control section where the dam centerline crosses the spillway channel allowing 0.2 velocity head for non-uniform velocity distribution, velocity transition losses and friction in the short approach channel. This is equivalent to calculating the spillway as a broad-crested weir with a discharge coefficient of 2.80.

6. Discharge over the irregular top of dam (the crest is not level) was calculated using a coefficient of 3.0 in the broad-crested weir equation for the sections of dam crest at different elevations. All spillway and overtopping discharge were included in a composite rating curve. Dummy values of 0.1 for dam length, coefficient of discharge and exponent were entered on the \$D card to suppress diagnostic statements in the output. The amount of this dummy flow is never greater than 0.02 cfs.

 FLOOD HYDROGRAPH PACKAGE (HFC-1)
 DAM SAFETY VERSION JULY 1978
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1	A	*****	ID #	30430	NO NAME	# 249	* ADD 680 FOR USGS ELEV.	*****
2	A	*****	DAM SAFETY PROGRAM	- U.	S.	CORPS OF ENGINEERS	*****	
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12	T						-1	-05
13	W2		0.17					0.04
14	X		-0.10	2.0				
15	K	1	15					
16	I	*****	RESERVOIR ROUTING	- RATING CURVE	SUPPLIED	- SLOPING DAM	*****	
17	Y				1			
18	Y1	1					-119.7	-1
19	Y4	119.7	119.8	120.0	120.2	120.5	121.0	122.0
20	Y4	122.7	122.9	123.1	123.3	123.5	124.0	124.5
21	Y5	0.0	1.0	4.0	15.0	42.0	119.0	225.0
22	Y5	620.0	735.0	967.0	1042.0	1310.0	2573.0	4488.0
23	SA	0.0	6.89	10.1	16.5	24.8		
24	SE	A4	100	110	120	130		
25	SS	119.7						
26	SD	122.3	0.1	0.1	0.1			
27	K	90						

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 3 AUG 78

RUN DATE 12/19/78.
 TIME 10.17.32.

***** ID # 30430 NO NAME # 249 * ADD 680 FOR USGS ELEV. *****
 ***** DAM SAFETY PROGRAM - U. S. CORPS OF ENGINEERS *****
 ***** REITZ # JENS, INC. - SEPTEMBER 1978 *****

JOB SPECIFICATION
 NO NHR NUTN IDAY IHR IWIN METRC IPLY IPRT NSTAN
 288 0 5 -0 -0 -0 -0 -4 -0
 JOPEL NWT LROPT TRACE
 5 -0 -0

MULTI-PLAN ANALYSES TO BE PERFORMED

PLAN= 1 NRTIO= 9 LRTIO= 1
 RTIO= .10 .15 .20 .25 .30 .35 .40 .50 1.00

SUR-AREA RUNOFF COMPUTATION

***** INFLOW HYDROGRAPH - SCS METHOD *****
 ISTAO ICOMP IECON ITAPE JPLY JPRT INAME ISTAGE IAUTO
 PMF 0 -0 -0 1 3 1 -0 -0

HYDROGRAPH DATA
 IHYDG IUMG TARFA SNAP TRSDA TRSPC RATIO ISNOW ISAMF LOCAL
 1 2 .30 -0.00 .30 1.00 -0.000 -0 1 -0
 SPFF PMS R6 R12 R24 R48 R72 R96
 -0.00 25.60 101.00 120.00 130.00 -0.00 -0.00 -0.00

PRECIP DATA

LOSS DATA
 LROPT STOPR DLTGR RTIOL FRAIN STRKS RTIOK STRTL CNSTL ALSMX RTIMP
 -0 -0.00 -0.00 1.00 -0.00 -0.00 1.00 -1.00 -85.00 -0.00 .04

CURVE NO = -85.00 WETNFSS = -1.00 EFFECT CN = 85.00

UNIT HYDROGRAPH DATA
 TC = -0.00 LAG = .17

RECESSION DATA

STRTO = -0.00 QRCNSN = -.10 RTIOR = 2.00
 UNIT HYDROGRAPH 12 END OF PERIOD ORDINATES, TC = -0.00 HOURS, LAG = .17 VOL = 1.00
 205. 622. 639. 400. 201. 107. 57. 30. 16. 8.
 5. 2.

END-OF-PERIOD FLOW
 MO.DA MR.MN PERIOD RAIN EXCS LOSS COMP 0 MO.DA MR.MN PERIOD RAIN EXCS LOSS COMP 0

MO-DA	HR-MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO-DA	HR-MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.00	.01	0.	1.01	12.05	145	.22	.20	.01	174.
1.01	.10	2	.01	.00	.01	0.	1.01	12.10	146	.22	.20	.01	262.
1.01	.15	3	.01	.00	.01	1.	1.01	12.15	147	.22	.20	.01	352.
1.01	.20	4	.01	.00	.01	1.	1.01	12.20	148	.22	.21	.01	409.
1.01	.25	5	.01	.00	.01	1.	1.01	12.25	149	.22	.21	.01	438.
1.01	.30	6	.01	.00	.01	1.	1.01	12.30	150	.22	.21	.01	454.
1.01	.35	7	.01	.00	.01	1.	1.01	12.35	151	.22	.21	.01	463.
1.01	.40	8	.01	.00	.01	1.	1.01	12.40	152	.22	.21	.01	468.
1.01	.45	9	.01	.00	.01	1.	1.01	12.45	153	.22	.21	.01	472.
1.01	.50	10	.01	.00	.01	1.	1.01	12.50	154	.22	.21	.01	474.
1.01	.55	11	.01	.00	.01	1.	1.01	12.55	155	.22	.21	.01	475.
1.01	1.00	12	.01	.00	.01	1.	1.01	13.00	156	.22	.21	.01	476.
1.01	1.05	13	.01	.00	.01	1.	1.01	13.05	157	.26	.25	.01	486.
1.01	1.10	14	.01	.00	.01	1.	1.01	13.10	158	.26	.25	.01	513.
1.01	1.15	15	.01	.00	.01	1.	1.01	13.15	159	.26	.25	.01	540.
1.01	1.20	16	.01	.00	.01	1.	1.01	13.20	160	.26	.25	.01	558.
1.01	1.25	17	.01	.00	.01	1.	1.01	13.25	161	.26	.25	.01	567.
1.01	1.30	18	.01	.00	.01	1.	1.01	13.30	162	.26	.25	.01	572.
1.01	1.35	19	.01	.00	.01	1.	1.01	13.35	163	.26	.25	.01	575.
1.01	1.40	20	.01	.00	.01	1.	1.01	13.40	164	.26	.25	.01	577.
1.01	1.45	21	.01	.00	.01	1.	1.01	13.45	165	.26	.25	.01	578.
1.01	1.50	22	.01	.00	.01	1.	1.01	13.50	166	.26	.25	.01	579.
1.01	1.55	23	.01	.00	.01	1.	1.01	13.55	167	.26	.25	.00	580.
1.01	2.00	24	.01	.00	.01	1.	1.01	14.00	168	.26	.25	.00	581.
1.01	2.05	25	.01	.00	.01	1.	1.01	14.05	169	.32	.32	.01	594.
1.01	2.10	26	.01	.00	.01	1.	1.01	14.10	170	.32	.32	.01	634.
1.01	2.15	27	.01	.00	.01	1.	1.01	14.15	171	.32	.32	.01	675.
1.01	2.20	28	.01	.00	.01	2.	1.01	14.20	172	.32	.32	.00	701.
1.01	2.25	29	.01	.00	.01	2.	1.01	14.25	173	.32	.32	.00	714.
1.01	2.30	30	.01	.00	.01	3.	1.01	14.30	174	.32	.32	.00	722.
1.01	2.35	31	.01	.00	.01	3.	1.01	14.35	175	.32	.32	.00	726.
1.01	2.40	32	.01	.00	.01	3.	1.01	14.40	176	.32	.32	.00	728.
1.01	2.45	33	.01	.00	.01	4.	1.01	14.45	177	.32	.32	.00	730.
1.01	2.50	34	.01	.00	.01	4.	1.01	14.50	178	.32	.32	.00	731.
1.01	2.55	35	.01	.00	.01	5.	1.01	14.55	179	.32	.32	.00	731.
1.01	3.00	36	.01	.00	.01	5.	1.01	15.00	180	.32	.32	.00	732.
1.01	3.05	37	.01	.00	.01	6.	1.01	15.05	181	.20	.19	.00	706.
1.01	3.10	38	.01	.00	.01	6.	1.01	15.10	182	.39	.39	.00	669.
1.01	3.15	39	.01	.00	.01	6.	1.01	15.15	183	.39	.39	.00	710.
1.01	3.20	40	.01	.00	.01	7.	1.01	15.20	184	.59	.58	.01	824.
1.01	3.25	41	.01	.00	.01	7.	1.01	15.25	185	.69	.68	.01	1018.
1.01	3.30	42	.01	.00	.01	7.	1.01	15.30	186	1.67	1.66	.01	1429.
1.01	3.35	43	.01	.00	.01	8.	1.01	15.35	187	2.75	2.73	.02	2411.
1.01	3.40	44	.01	.00	.01	8.	1.01	15.40	188	1.08	1.08	.01	3449.
1.01	3.45	45	.01	.00	.01	9.	1.01	15.45	189	.59	.59	.00	3460.
1.01	3.50	46	.01	.00	.01	9.	1.01	15.50	190	.59	.59	.00	2788.
1.01	3.55	47	.01	.00	.01	9.	1.01	15.55	191	.39	.39	.00	2106.
1.01	4.00	48	.01	.00	.01	9.	1.01	16.00	192	.39	.39	.00	1611.
1.01	4.05	49	.01	.00	.01	10.	1.01	16.05	193	.30	.30	.00	1265.
1.01	4.10	50	.01	.00	.01	10.	1.01	16.10	194	.30	.30	.00	1024.
1.01	4.15	51	.01	.00	.01	10.	1.01	16.15	195	.30	.30	.00	871.
1.01	4.20	52	.01	.00	.01	11.	1.01	16.20	196	.30	.30	.00	784.
1.01	4.25	53	.01	.01	.01	11.	1.01	16.25	197	.30	.30	.00	738.
1.01	4.30	54	.01	.01	.01	11.	1.01	16.30	198	.30	.30	.00	712.
1.01	4.35	55	.01	.01	.01	12.	1.01	16.35	199	.30	.30	.00	698.
1.01	4.40	56	.01	.01	.01	12.	1.01	16.40	200	.30	.30	.00	693.
1.01	4.45	57	.01	.01	.01	12.	1.01	16.45	201	.30	.30	.00	690.
1.01	4.50	58	.01	.01	.01	12.	1.01	16.50	202	.30	.30	.00	689.
1.01	4.55	59	.01	.01	.01	13.	1.01	16.55	203	.30	.30	.00	689.
1.01	5.00	60	.01	.01	.01	13.	1.01	17.00	204	.30	.30	.00	689.

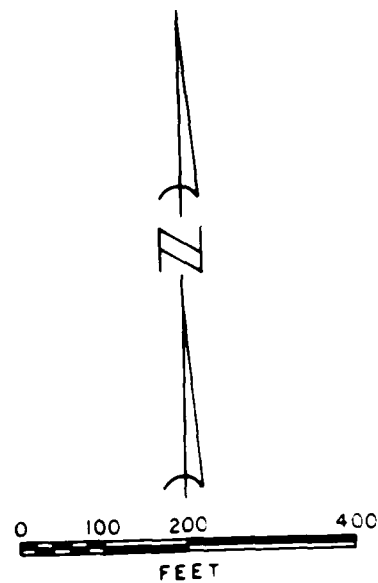
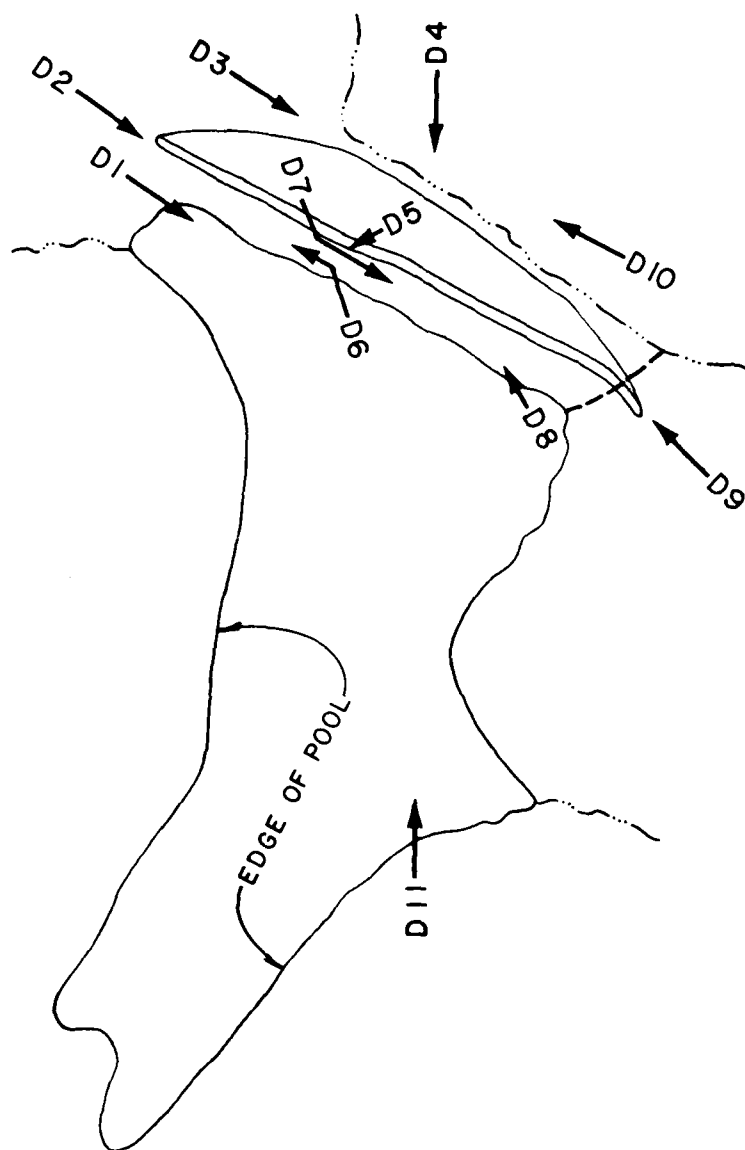
1.01	5.05	61	.01	.01	.01	13.	1.01	17.05	205	.24	.24	.00	676.
1.01	5.10	62	.01	.01	.01	13.	1.01	17.10	206	.24	.24	.00	636.
1.01	5.15	63	.01	.01	.01	14.	1.01	17.15	207	.24	.24	.00	594.
1.01	5.20	64	.01	.01	.01	14.	1.01	17.20	208	.24	.24	.00	569.
1.01	5.25	65	.01	.01	.01	14.	1.01	17.25	209	.24	.24	.00	556.
1.01	5.30	66	.01	.01	.01	14.	1.01	17.30	210	.24	.24	.00	549.
1.01	5.35	67	.01	.01	.01	15.	1.01	17.35	211	.24	.24	.00	545.
1.01	5.40	68	.01	.01	.01	15.	1.01	17.40	212	.24	.24	.00	543.
1.01	5.45	69	.01	.01	.01	15.	1.01	17.45	213	.24	.24	.00	542.
1.01	5.50	70	.01	.01	.01	15.	1.01	17.50	214	.24	.24	.00	542.
1.01	5.55	71	.01	.01	.01	15.	1.01	17.55	215	.24	.24	.00	541.
1.01	6.00	72	.01	.01	.01	16.	1.01	18.00	216	.24	.24	.00	541.
1.01	6.05	73	.07	.03	.03	21.	1.01	18.05	217	.02	.02	.00	497.
1.01	6.10	74	.07	.04	.03	39.	1.01	18.10	218	.02	.02	.00	364.
1.01	6.15	75	.07	.04	.03	58.	1.01	18.15	219	.02	.02	.00	326.
1.01	6.20	76	.07	.04	.03	71.	1.01	18.20	220	.02	.02	.00	304.
1.01	6.25	77	.07	.04	.03	80.	1.01	18.25	221	.02	.02	.00	284.
1.01	6.30	78	.07	.04	.03	86.	1.01	18.30	222	.02	.02	.00	265.
1.01	6.35	79	.07	.04	.02	90.	1.01	18.35	223	.02	.02	.00	247.
1.01	6.40	80	.07	.04	.02	94.	1.01	18.40	224	.02	.02	.00	230.
1.01	6.45	81	.07	.05	.02	97.	1.01	18.45	225	.02	.02	.00	215.
1.01	6.50	82	.07	.05	.02	100.	1.01	18.50	226	.02	.02	.00	201.
1.01	6.55	83	.07	.05	.02	103.	1.01	18.55	227	.02	.02	.00	187.
1.01	7.00	84	.07	.05	.02	105.	1.01	19.00	228	.02	.02	.00	175.
1.01	7.05	85	.07	.05	.02	107.	1.01	19.05	229	.02	.02	.00	163.
1.01	7.10	86	.07	.05	.02	109.	1.01	19.10	230	.02	.02	.00	152.
1.01	7.15	87	.07	.05	.02	111.	1.01	19.15	231	.02	.02	.00	142.
1.01	7.20	88	.07	.05	.02	113.	1.01	19.20	232	.02	.02	.00	132.
1.01	7.25	89	.07	.05	.02	114.	1.01	19.25	233	.02	.02	.00	123.
1.01	7.30	90	.07	.05	.02	116.	1.01	19.30	234	.02	.02	.00	115.
1.01	7.35	91	.07	.05	.01	118.	1.01	19.35	235	.02	.02	.00	107.
1.01	7.40	92	.07	.05	.01	119.	1.01	19.40	236	.02	.02	.00	100.
1.01	7.45	93	.07	.05	.01	120.	1.01	19.45	237	.02	.02	.00	94.
1.01	7.50	94	.07	.05	.01	121.	1.01	19.50	238	.02	.02	.00	87.
1.01	7.55	95	.07	.05	.01	123.	1.01	19.55	239	.02	.02	.00	81.
1.01	8.00	96	.07	.06	.01	124.	1.01	20.00	240	.02	.02	.00	76.
1.01	8.05	97	.07	.06	.01	125.	1.01	20.05	241	.02	.02	.00	71.
1.01	8.10	98	.07	.06	.01	126.	1.01	20.10	242	.02	.02	.00	66.
1.01	8.15	99	.07	.06	.01	127.	1.01	20.15	243	.02	.02	.00	62.
1.01	8.20	100	.07	.06	.01	128.	1.01	20.20	244	.02	.02	.00	58.
1.01	8.25	101	.07	.06	.01	129.	1.01	20.25	245	.02	.02	.00	54.
1.01	8.30	102	.07	.06	.01	129.	1.01	20.30	246	.02	.02	.00	50.
1.01	8.35	103	.07	.06	.01	130.	1.01	20.35	247	.02	.02	.00	49.
1.01	8.40	104	.07	.06	.01	131.	1.01	20.40	248	.02	.02	.00	49.
1.01	8.45	105	.07	.06	.01	132.	1.01	20.45	249	.02	.02	.00	49.
1.01	8.50	106	.07	.06	.01	132.	1.01	20.50	250	.02	.02	.00	49.
1.01	8.55	107	.07	.06	.01	133.	1.01	20.55	251	.02	.02	.00	49.
1.01	9.00	108	.07	.06	.01	134.	1.01	21.00	252	.02	.02	.00	49.
1.01	9.05	109	.07	.06	.01	134.	1.01	21.05	253	.02	.02	.00	49.
1.01	9.10	110	.07	.06	.01	135.	1.01	21.10	254	.02	.02	.00	49.
1.01	9.15	111	.07	.06	.01	135.	1.01	21.15	255	.02	.02	.00	49.
1.01	9.20	112	.07	.06	.01	136.	1.01	21.20	256	.02	.02	.00	49.
1.01	9.25	113	.07	.06	.01	136.	1.01	21.25	257	.02	.02	.00	49.
1.01	9.30	114	.07	.06	.01	137.	1.01	21.30	258	.02	.02	.00	49.
1.01	9.35	115	.07	.06	.01	137.	1.01	21.35	259	.02	.02	.00	49.
1.01	9.40	116	.07	.06	.01	138.	1.01	21.40	260	.02	.02	.00	49.
1.01	9.45	117	.07	.06	.01	138.	1.01	21.45	261	.02	.02	.00	49.
1.01	9.50	118	.07	.06	.01	139.	1.01	21.50	262	.02	.02	.00	49.
1.01	9.55	119	.07	.06	.01	139.	1.01	21.55	263	.02	.02	.00	49.
1.01	10.00	120	.07	.06	.01	139.	1.01	22.00	264	.02	.02	.00	49.

1.01	10.05	121	.07	.06	.01	140.	1.01	22.05	265	.02	.02	.00	49.
1.01	10.10	122	.07	.06	.01	140.	1.01	22.10	266	.02	.02	.00	49.
1.01	10.15	123	.07	.06	.01	140.	1.01	22.15	267	.02	.02	.00	49.
1.01	10.20	124	.07	.06	.01	141.	1.01	22.20	268	.02	.02	.00	49.
1.01	10.25	125	.07	.06	.01	141.	1.01	22.25	269	.02	.02	.00	49.
1.01	10.30	126	.07	.06	.01	141.	1.01	22.30	270	.02	.02	.00	49.
1.01	10.35	127	.07	.06	.01	142.	1.01	22.35	271	.02	.02	.00	49.
1.01	10.40	128	.07	.06	.01	142.	1.01	22.40	272	.02	.02	.00	49.
1.01	10.45	129	.07	.06	.01	142.	1.01	22.45	273	.02	.02	.00	49.
1.01	10.50	130	.07	.06	.01	143.	1.01	22.50	274	.02	.02	.00	49.
1.01	10.55	131	.07	.06	.00	143.	1.01	22.55	275	.02	.02	.00	49.
1.01	11.00	132	.07	.06	.00	143.	1.01	23.00	276	.02	.02	.00	49.
1.01	11.05	133	.07	.06	.00	143.	1.01	23.05	277	.02	.02	.00	49.
1.01	11.10	134	.07	.06	.00	144.	1.01	23.10	278	.02	.02	.00	49.
1.01	11.15	135	.07	.06	.00	144.	1.01	23.15	279	.02	.02	.00	49.
1.01	11.20	136	.07	.06	.00	144.	1.01	23.20	280	.02	.02	.00	49.
1.01	11.25	137	.07	.06	.00	144.	1.01	23.25	281	.02	.02	.00	49.
1.01	11.30	138	.07	.06	.00	144.	1.01	23.30	282	.02	.02	.00	49.
1.01	11.35	139	.07	.06	.00	145.	1.01	23.35	283	.02	.02	.00	49.
1.01	11.40	140	.07	.06	.00	145.	1.01	23.40	284	.02	.02	.00	49.
1.01	11.45	141	.07	.06	.00	145.	1.01	23.45	285	.02	.02	.00	49.
1.01	11.50	142	.07	.06	.00	145.	1.01	23.50	286	.02	.02	.00	49.
1.01	11.55	143	.07	.06	.00	145.	1.01	23.55	287	.02	.02	.00	49.
1.01	12.00	144	.07	.06	.00	146.	1.02	0.00	288	.02	.02	.00	49.
SUM										33.28	31.33	1.95	74112.
										(.845.)	(.796.)	(.49.)	(.2098.62)

SUM	33.28	31.33	1.95	74112.
	(845.)	(796.)	(49.)	(2098.62)

SUMMARY OF DAY SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALVE 119.70 248. 0.	SPILLWAY CREST 119.70 248. 0.	TOP OF DAM 122.30 293. 460.	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
					.10	121.02	0.00	270.	123.	0.00	16.08	0.00
					.15	121.41	0.00	277.	207.	0.00	16.08	0.00
					.20	121.77	0.00	283.	302.	0.00	16.00	0.00
					.25	122.09	0.00	289.	396.	0.00	16.00	0.00
					.30	122.39	.09	294.	496.	.33	16.00	0.00
					.35	122.66	.36	299.	604.	.75	16.00	0.00
					.40	122.89	.59	304.	732.	.92	16.00	0.00
					.50	123.30	1.00	312.	1047.	1.33	15.92	0.00
					1.00	124.11	1.81	327.	3242.	4.83	15.75	0.00

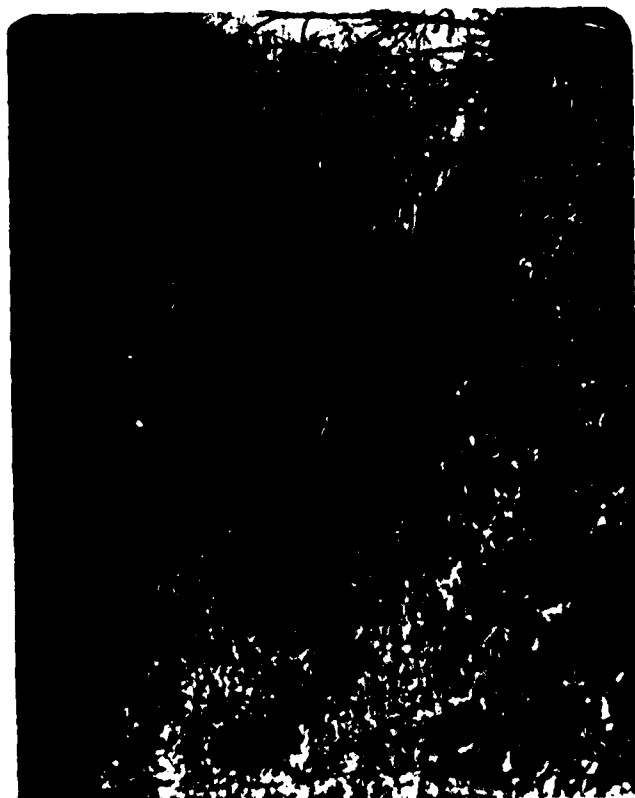


**PHOTO INDEX I
FOR
DAM**

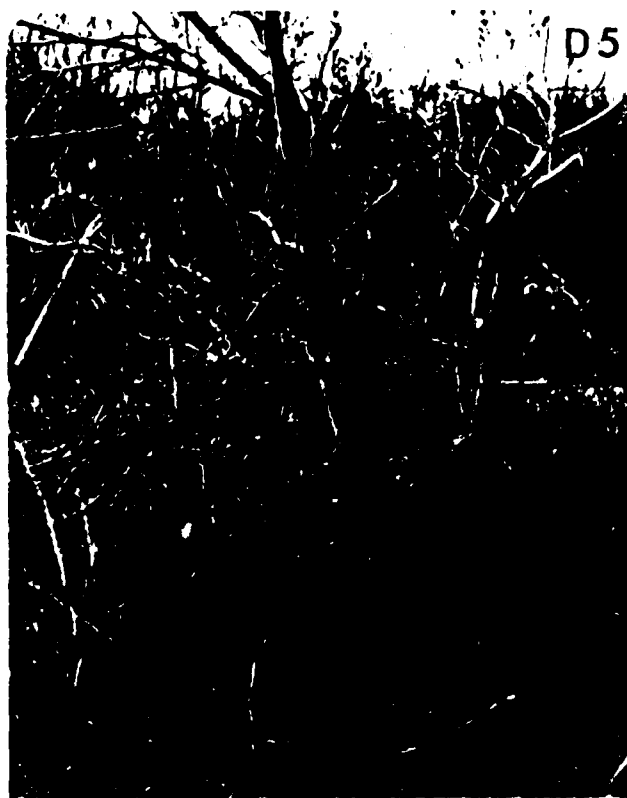
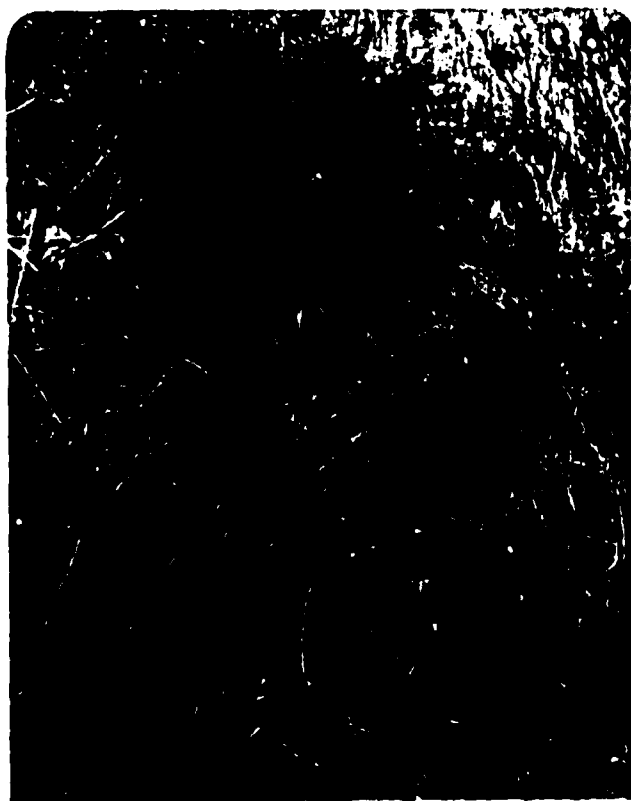
**NO NAME 249
JEFFERSON COUNTY, MO.
NOVEMBER 1978**

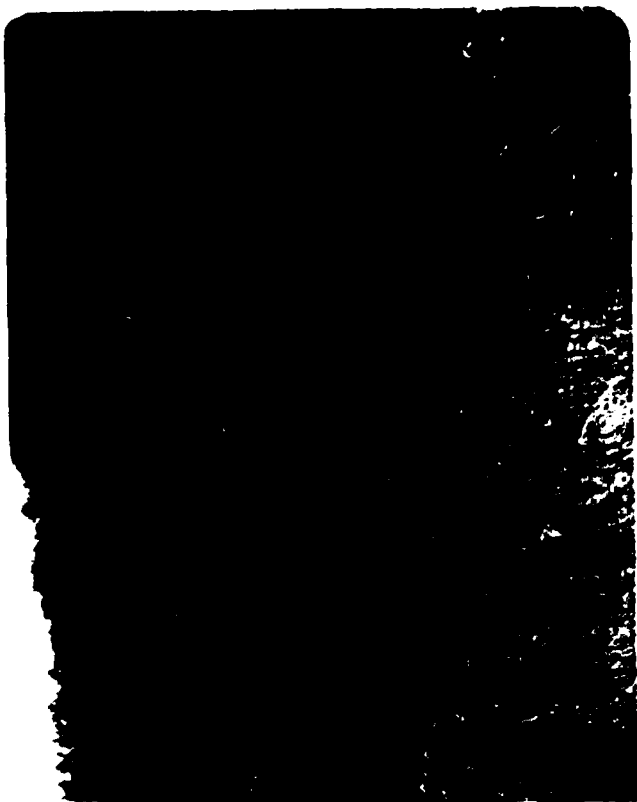
**PREPARED BY
REITZ & JENS, INC.**

D 4



DAM





D 9

D11



DAM

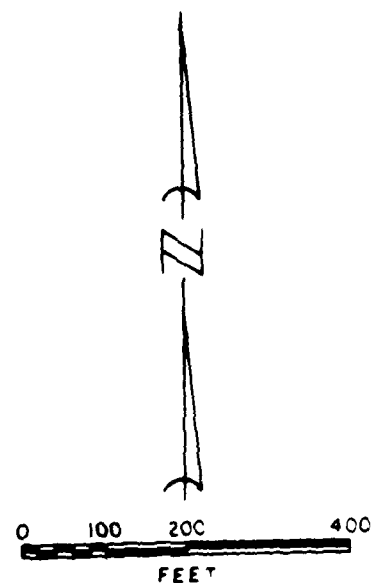
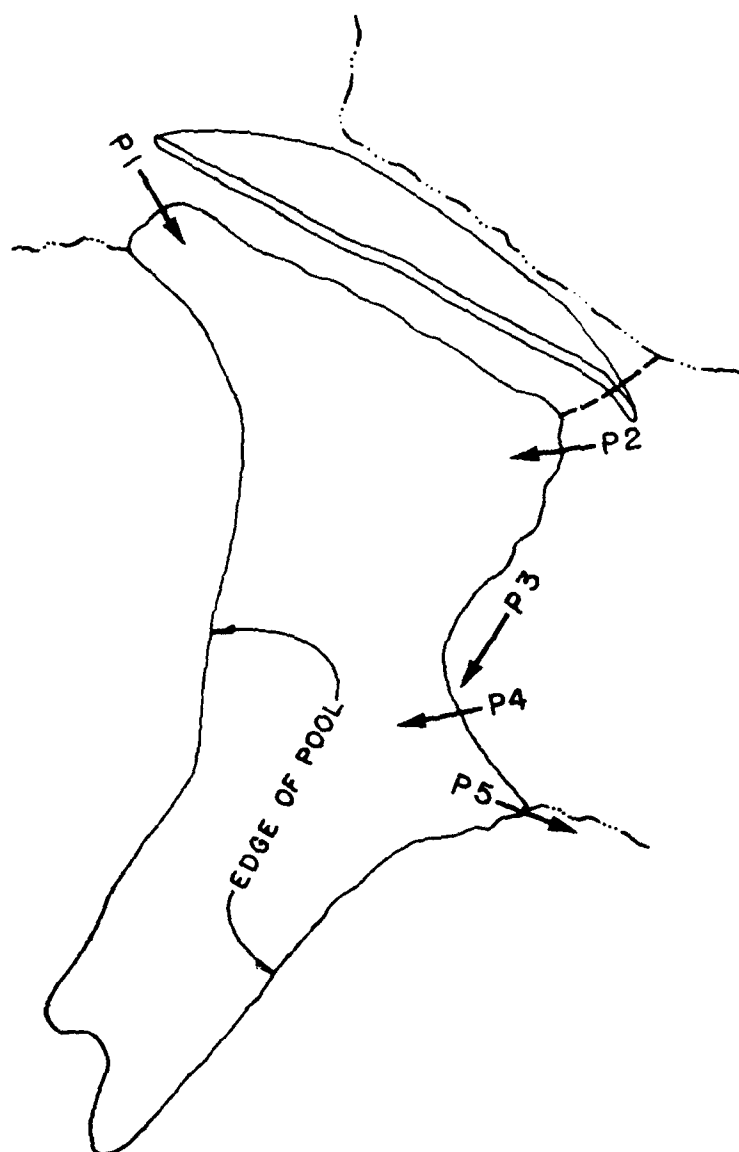
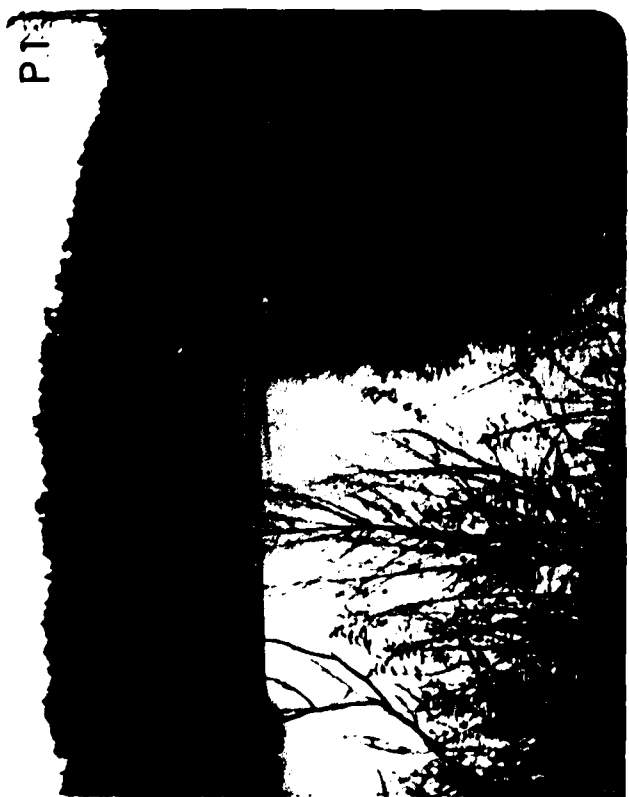


PHOTO INDEX 2
FOR
PANORAMA

NO NAME 249
JEFFERSON COUNTY, MO.
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC



PANORAMA

P 5



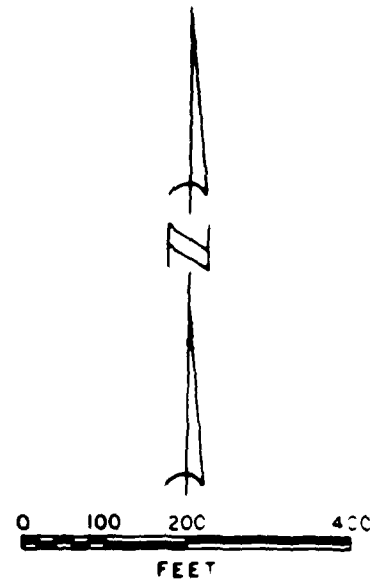
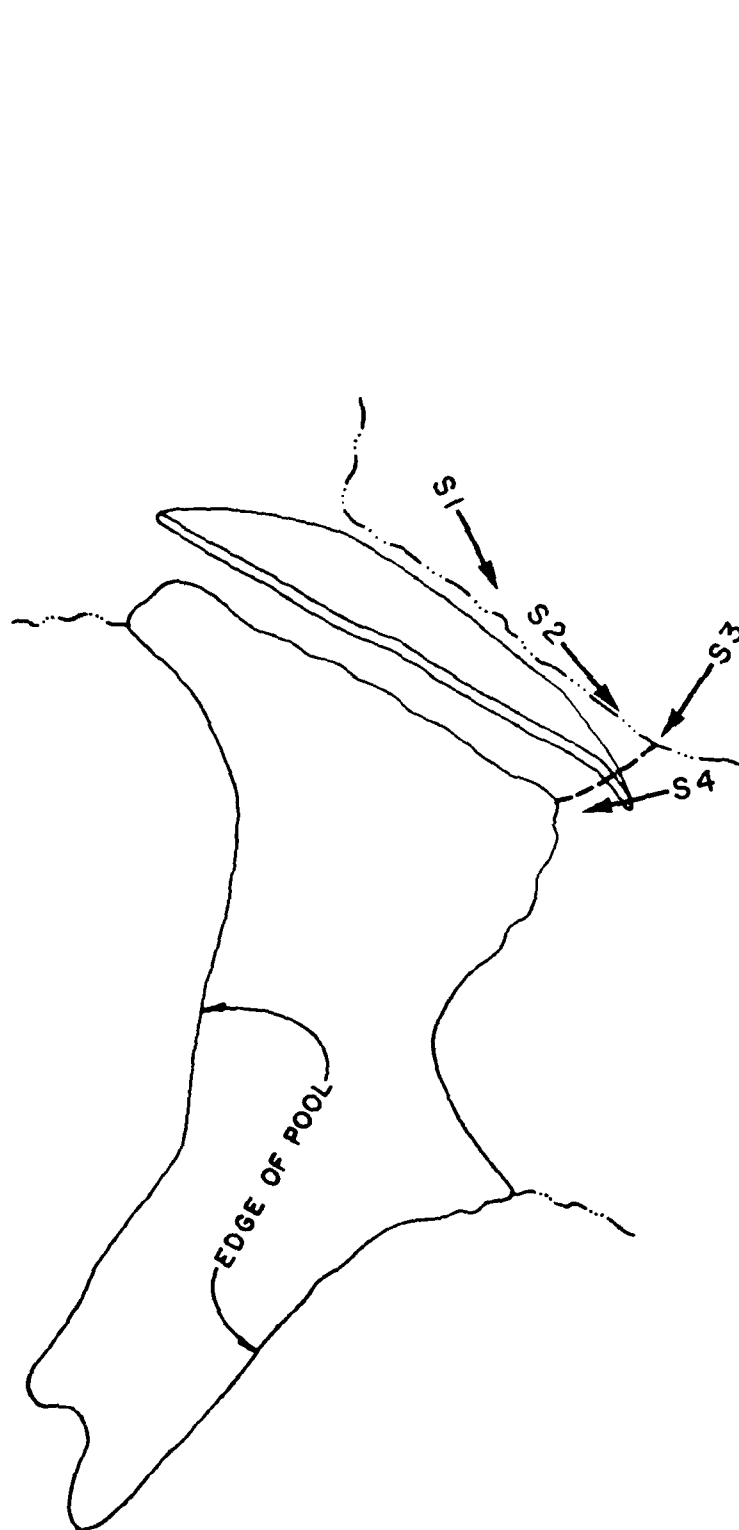
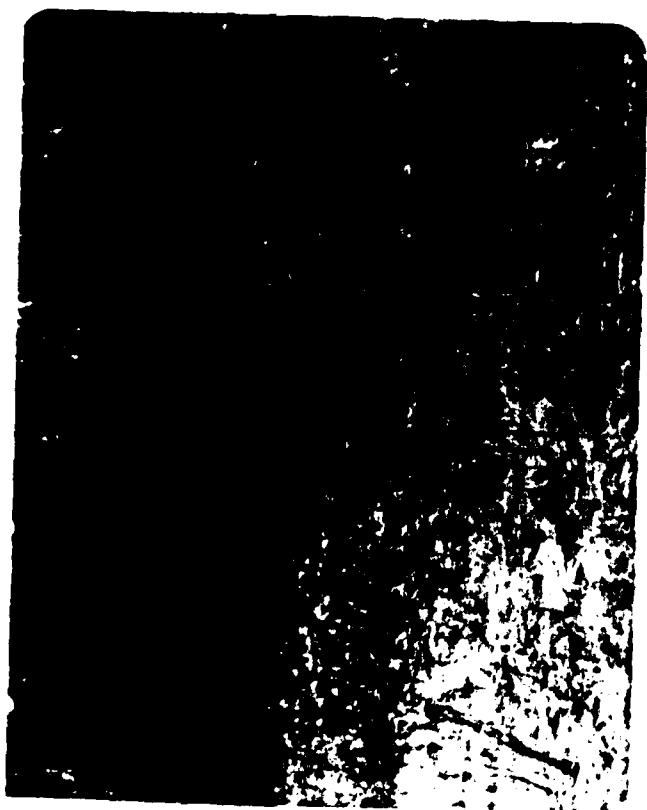
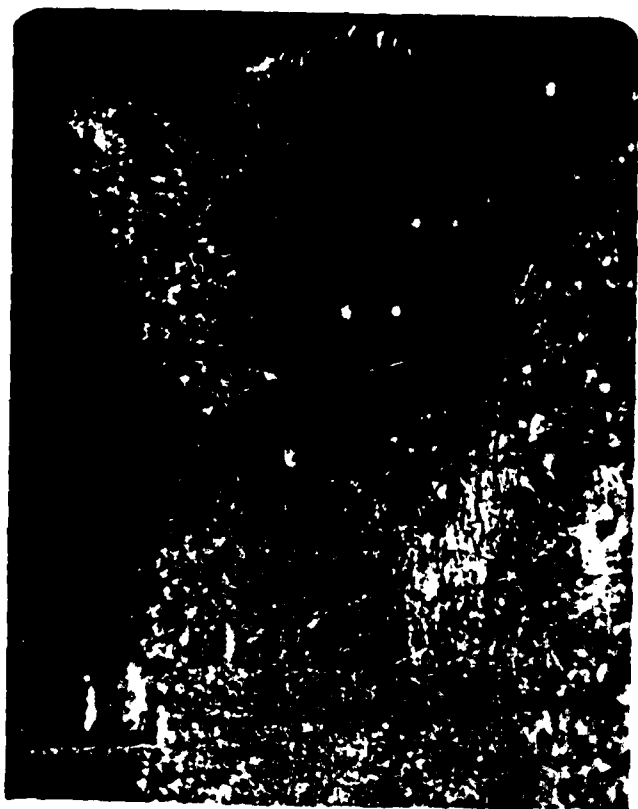


PHOTO INDEX 3
FOR
SPILLWAY

NO NAME 249
JEFFERSON COUNTY, MO.
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC



SPILLWAYS

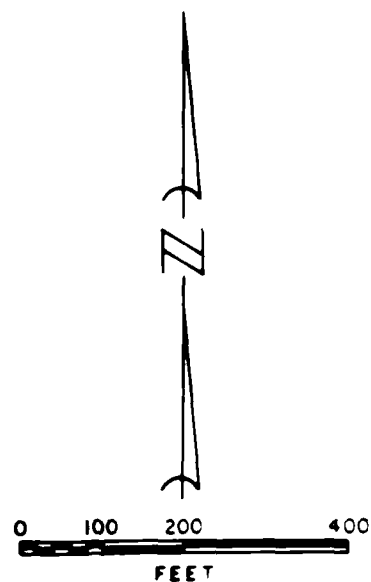
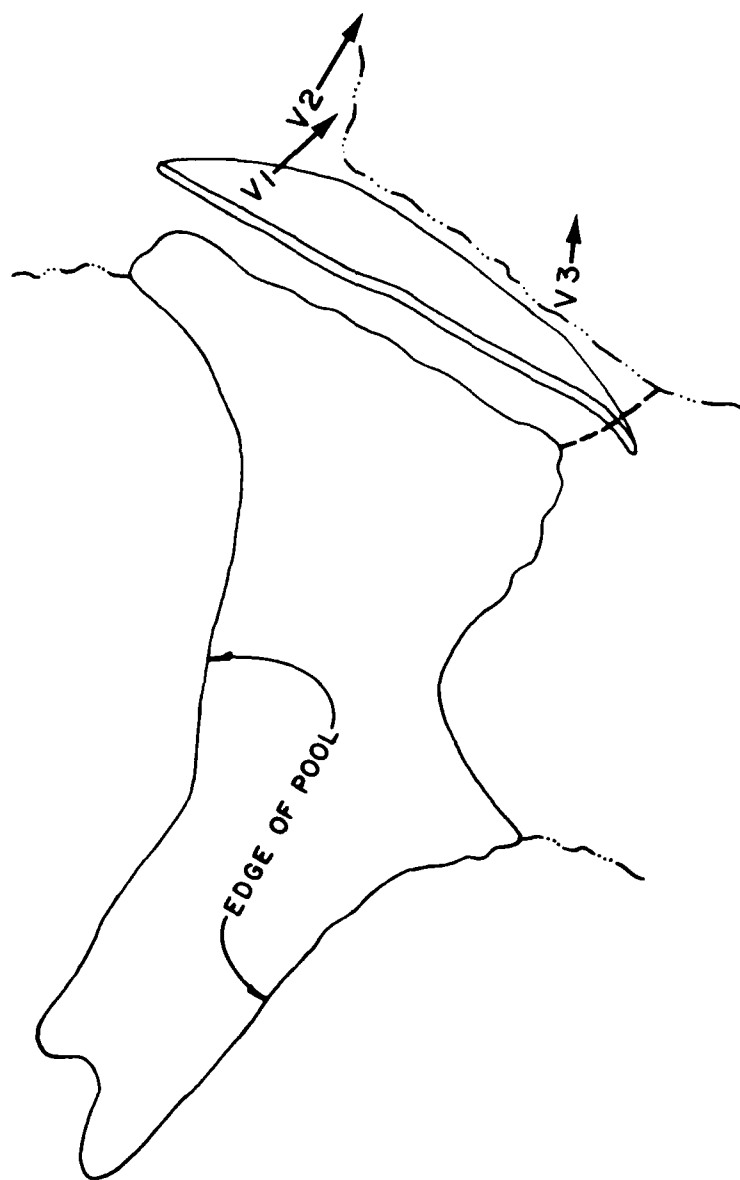


PHOTO INDEX 4
FOR
VALLEY BELOW DAM

NO NAME 249
JEFFERSON COUNTY, MO.
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC.



VALLEY BELOW DAM

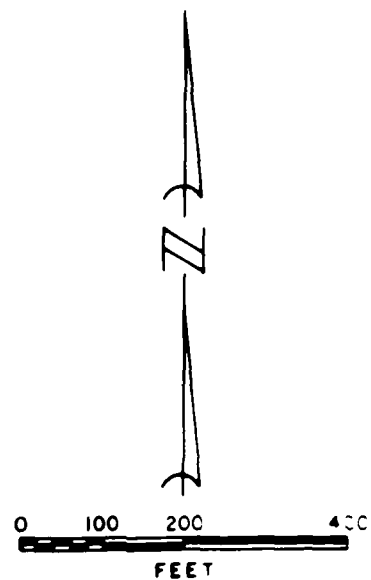
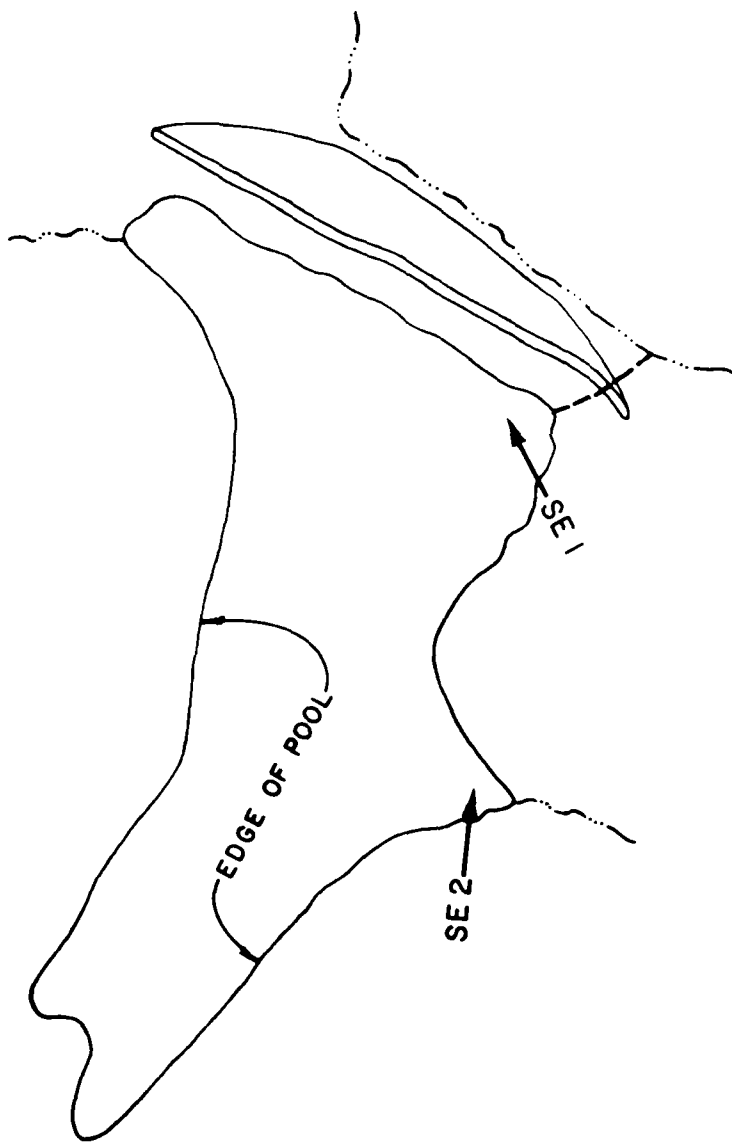


PHOTO INDEX 5
FOR
SEEPAGE

NO NAME 249
JEFFERSON COUNTY, MO.
NOVEMBER 1978

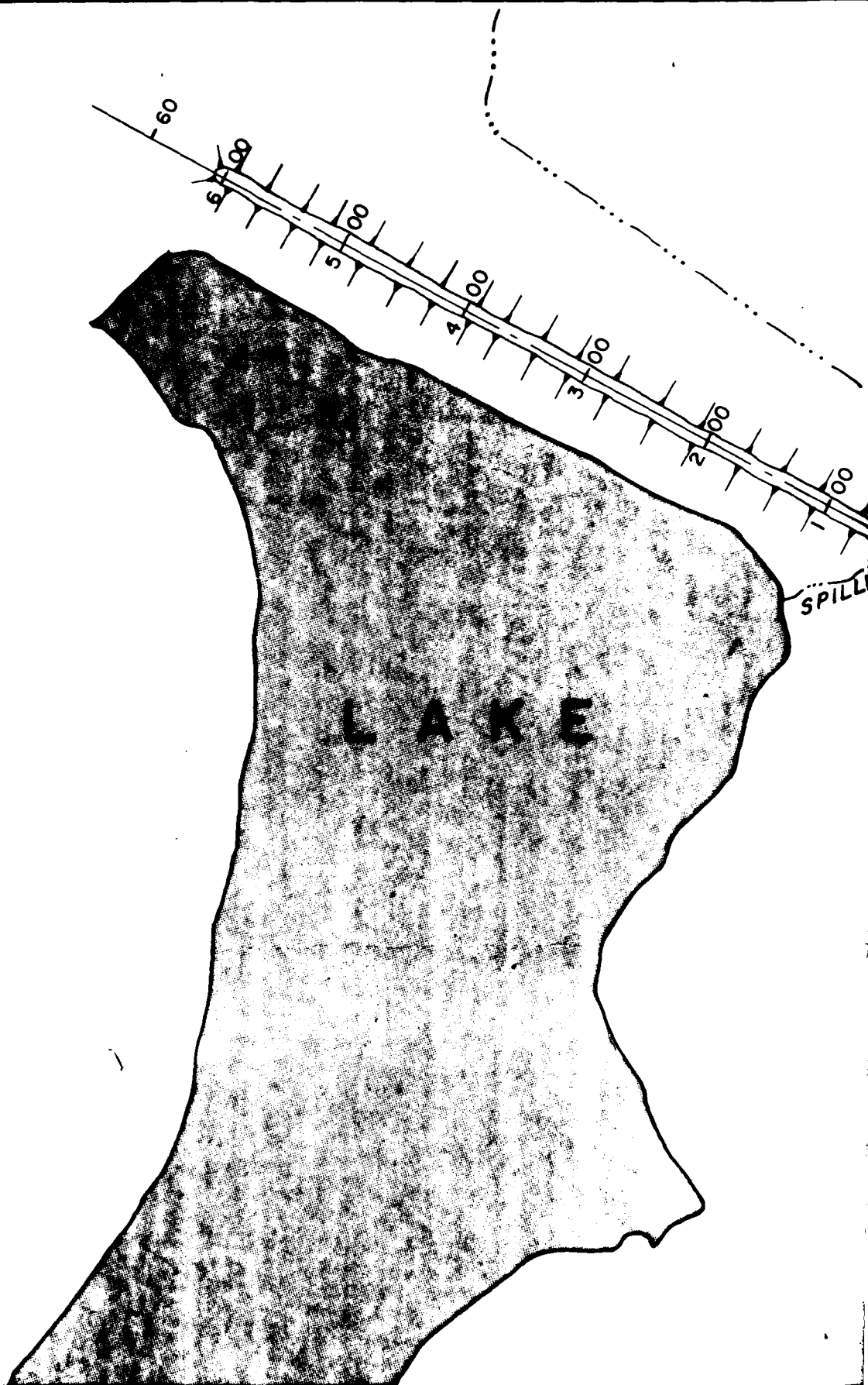
PREPARED BY
REITZ & JENS, INC.

SE 2



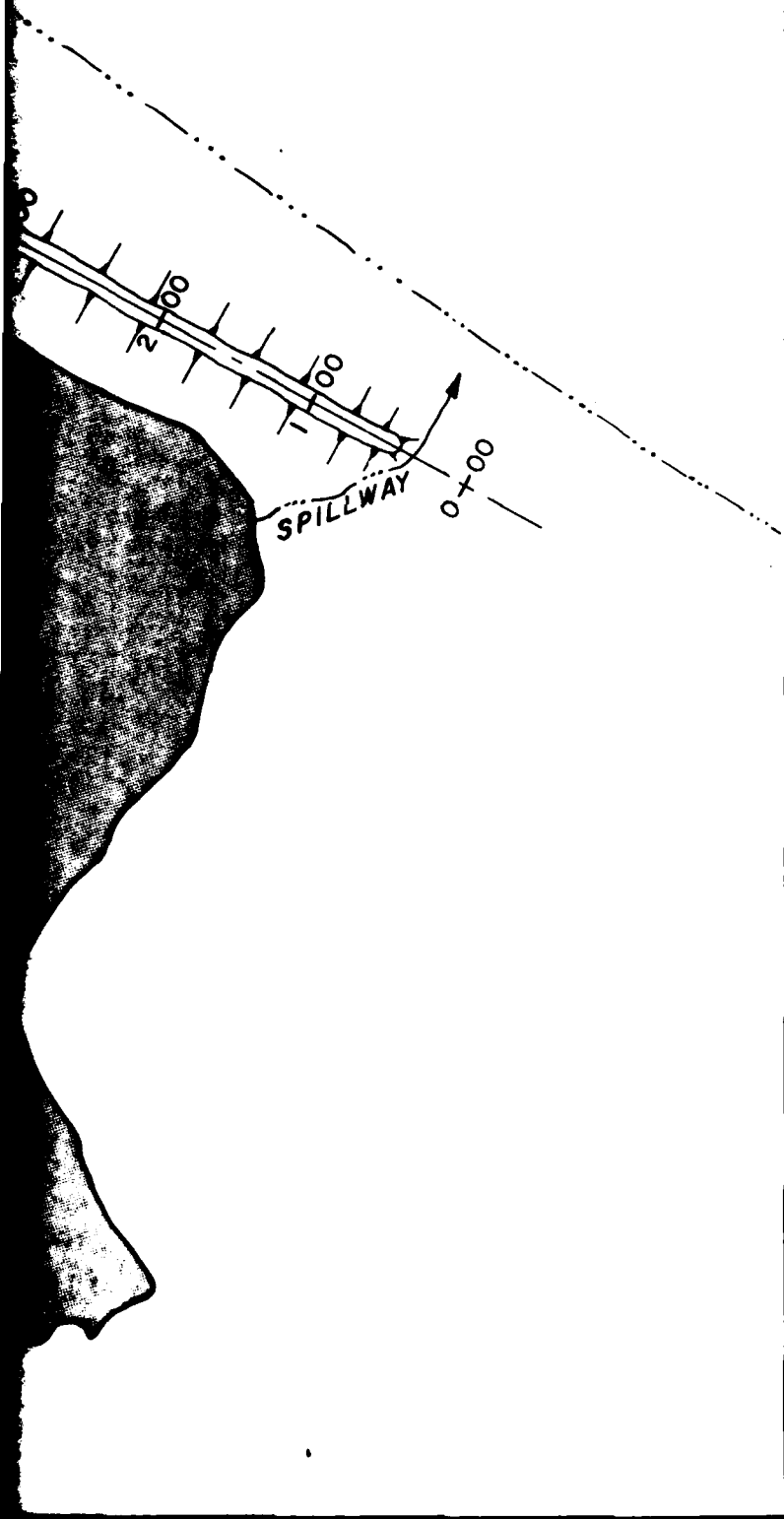
SEE PAGE

FINAL SURVEY	SURVEYED	BY	DATE
	PLOTTED		
NOTE BOOK NO.	TEMPLATE		
	AREAS		
	AREAS CHECKED		

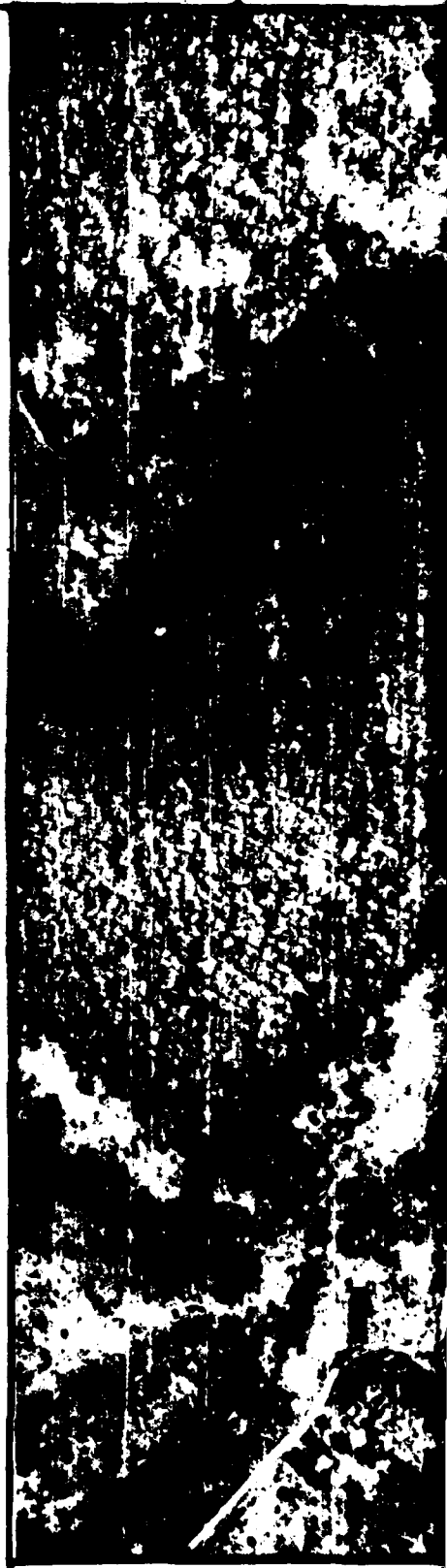


PLAN OF DAM AND SPILLWAY





SPILLWAY

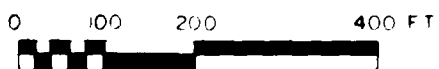


SPILLWAY

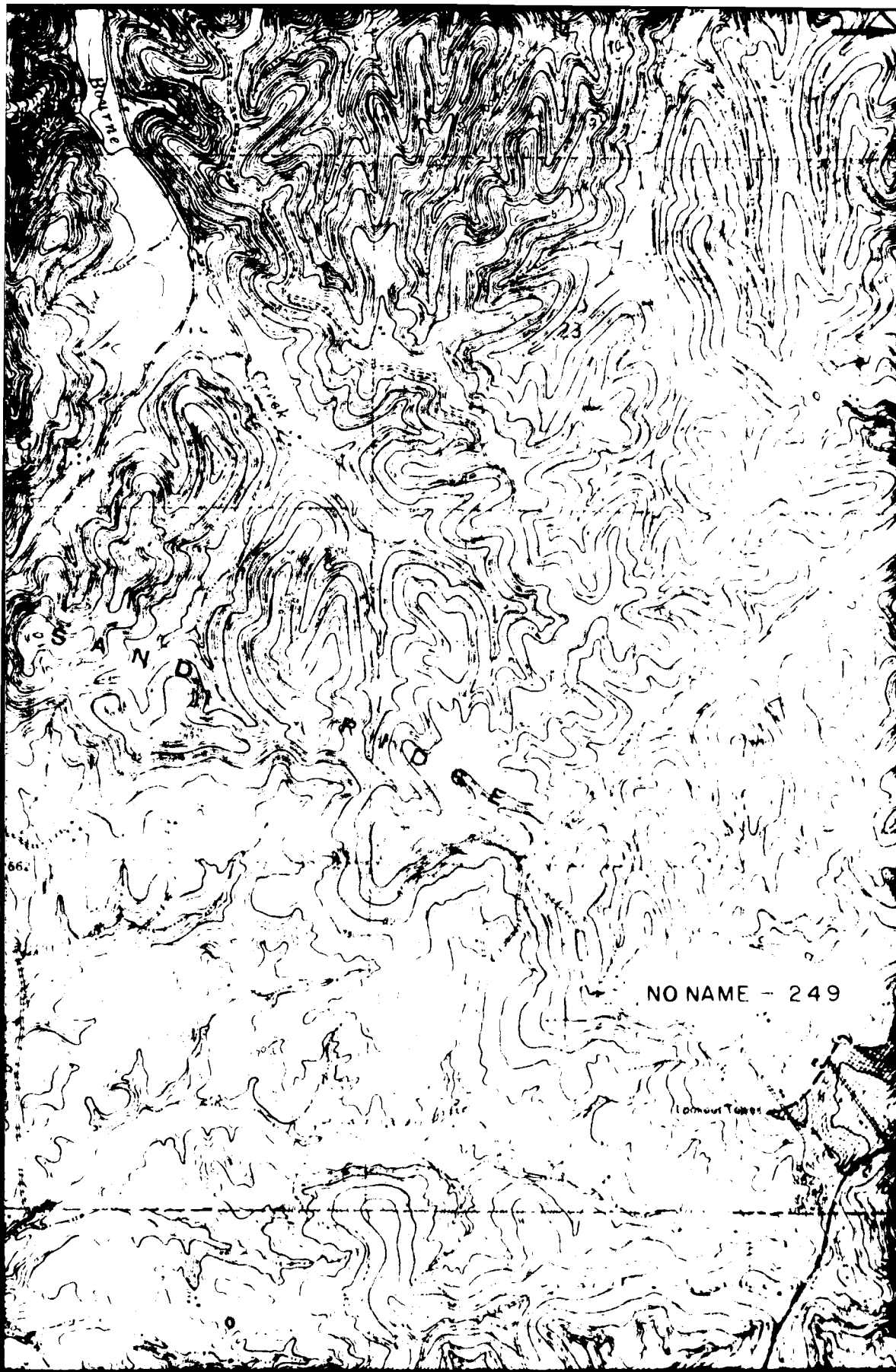
000 300 FT.



PLAN OF LAKE



- II -



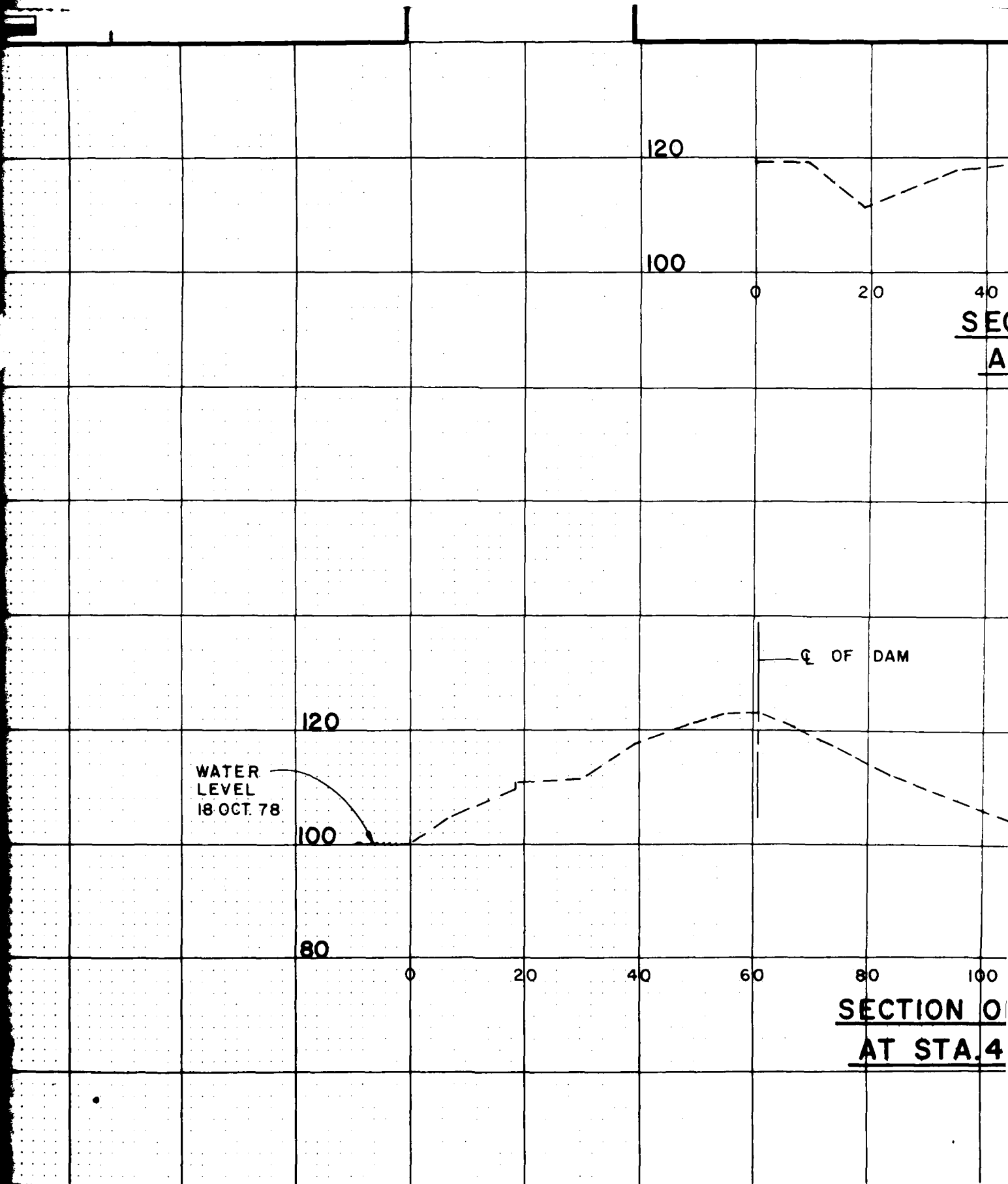
WATERSHED AND OUTFLOW CH

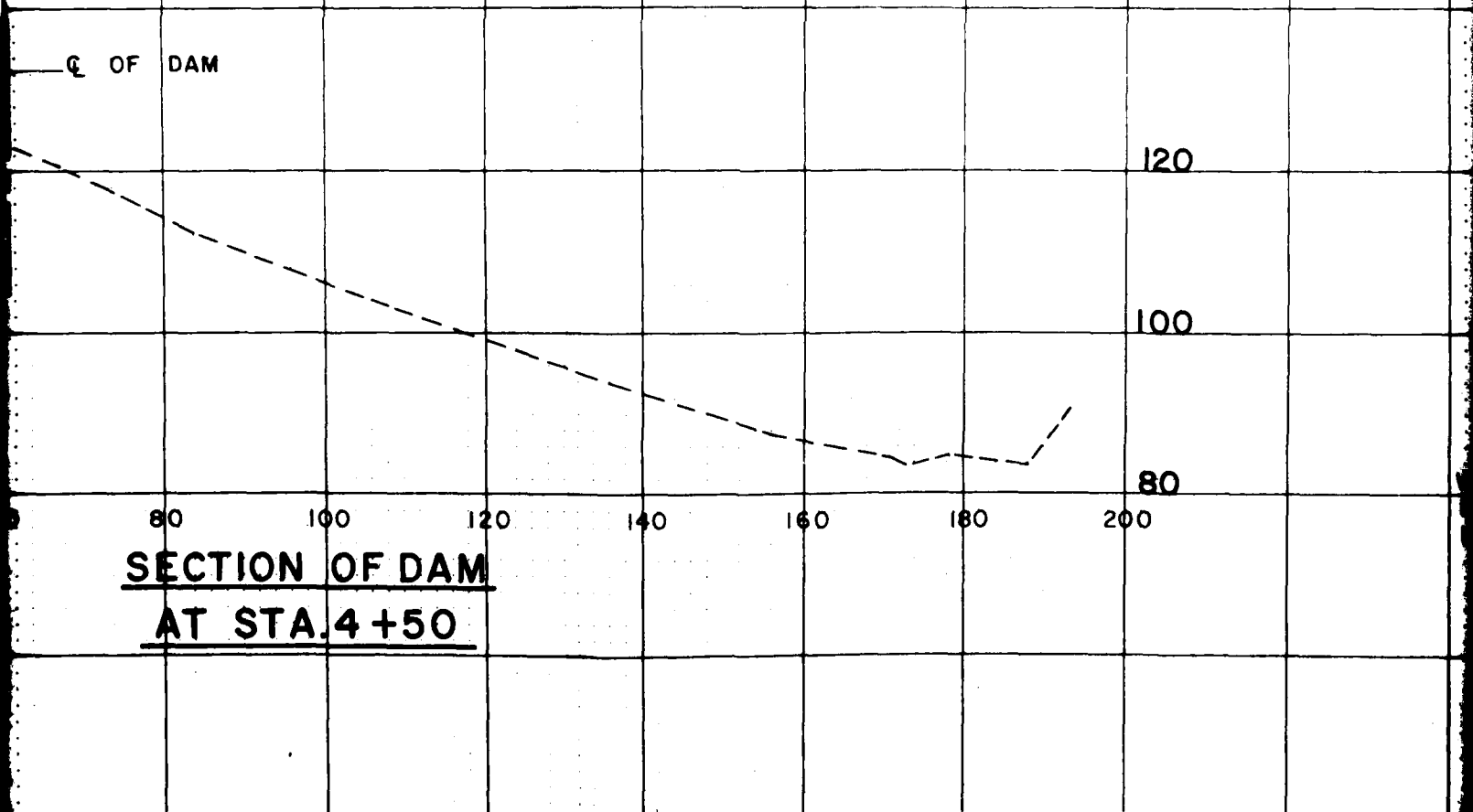
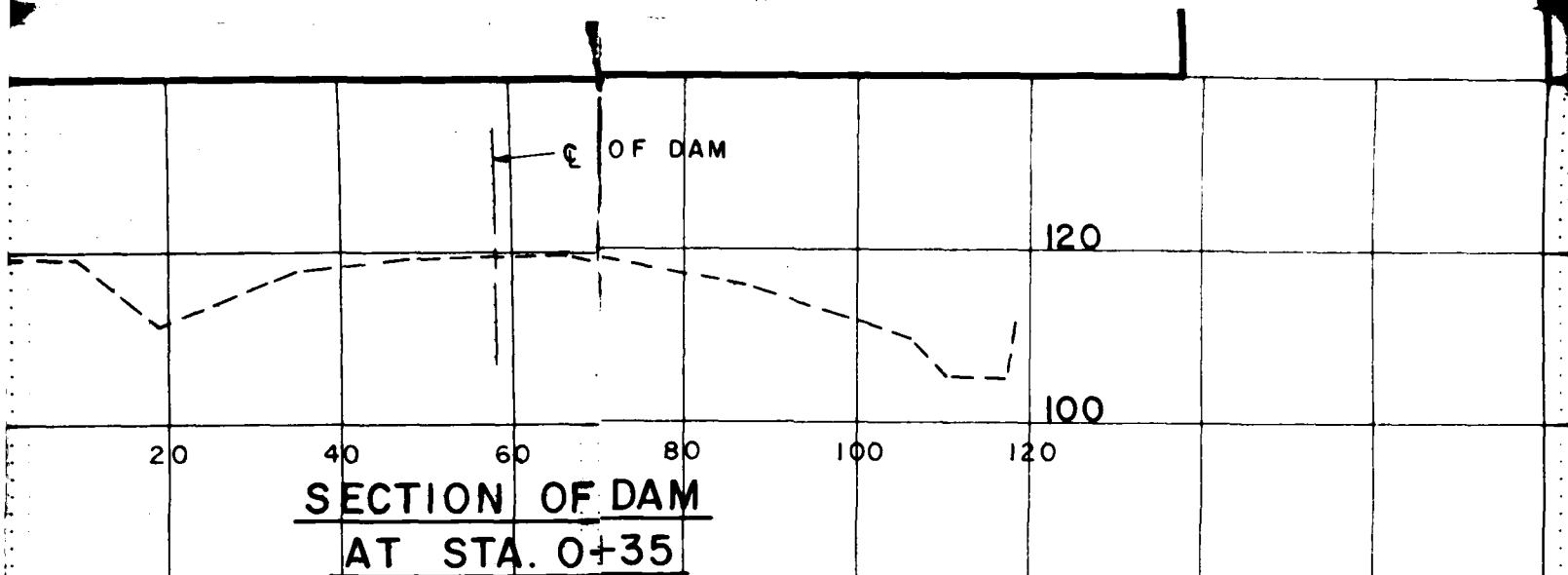




ED AND OUTFLOW CHANNEL







0 1000 2000 4000 6000 FT.

130

125

120

115

7+00

6+00

5+00

4+00

3+00

Q OF DAM

PROFILE OF
TOP OF DAM

SCALES
1" = 5' VERT.
1" = 100' HORIZ.

120

120

115

115

110

110

105

105

WATER
LEVEL
18 OCT. 78

100

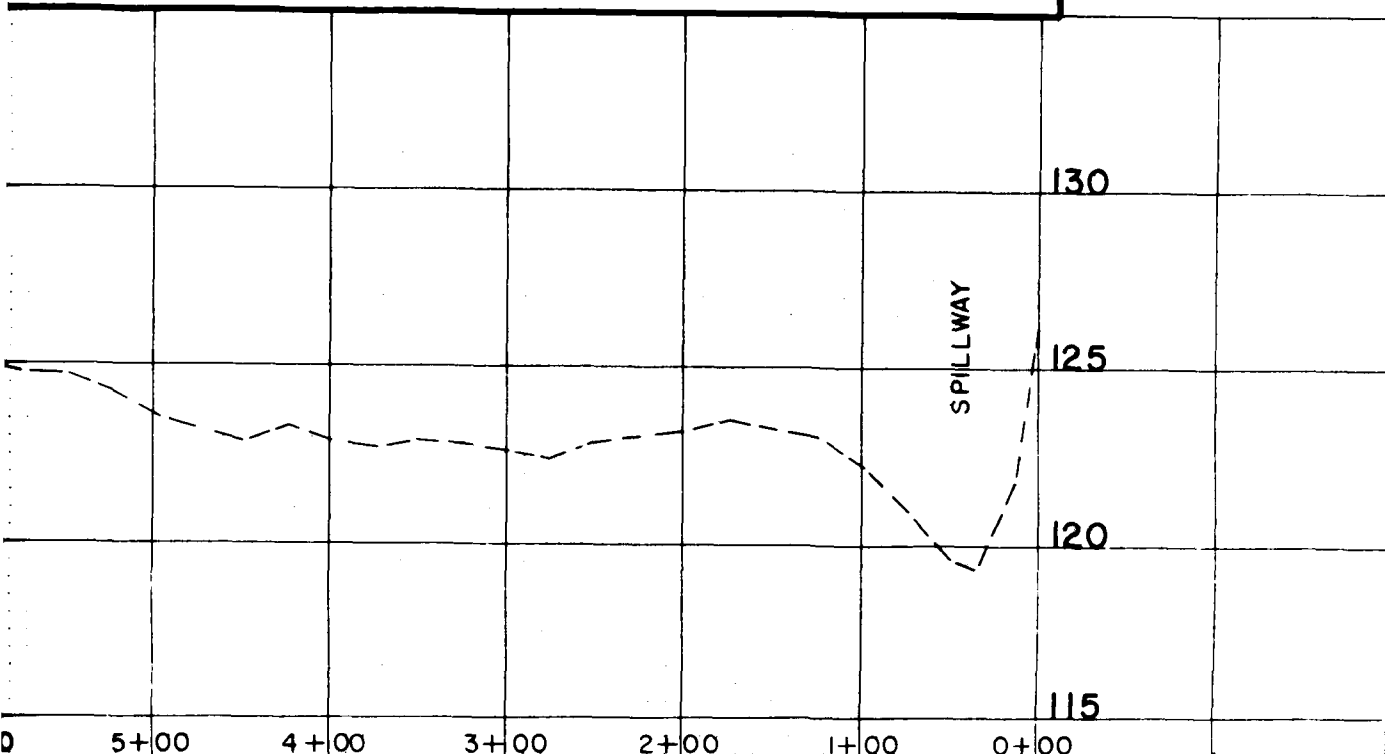
100

SCALES
1" = 5' VERT.
1" = 100' HORIZ.

PROFILE OF SPILLWAY

19

00 2000 4000 6000 FT.



**PROFILE OF
TOP OF DAM**

SCALES

1" = 5' VERT.

1" = 100' HORIZ.

NO NAME — 249

ADD 680' TO ELEVATIONS SHOWN
TO APPROX. USGS DATUM

PHASE I — INSPECTION

COUNTY I. D. NO. 099

JEFFERSON COUNTY, MISSOURI

INVENTORY NO. I. D. 30430

FOR ST. LOUIS DISTRICT, CORPS OF ENGINEERS

REITZ & JENS, INC.
CONSULTING ENGINEERS

ST. LOUIS, MISSOURI
DECEMBER 1978

PLATE 3